



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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7.3.2d

APPLICANT: GUIDOTTI ET AL.

SERIAL NUMBER: 09/315,251

Group Art Unit: 174

FILED: May 20, 1999

FOR: ENERGY STORAGE AND
CONVERSION DEVICES USING
THERMAL SPRAYED
ELECTRODES

Examiner: J. Maple

DECLARATION PURSUANT TO 37 C.F.R. § 1.132

The Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

RECEIVED
JUL 01 2002
TC 1700

Tongsan D. Xiao, declares and says that:

1. I have worked in the field of thermally sprayed coatings for 10 years. I
an inventor of the above referenced patent application.

2. I have read, understood, and am familiar with the above-referenced
application. I have also read, understood, and am familiar with the U.S. Patent No.
5,716,422 to Muffoletto et al.

3. During initial investigations into thermally spraying active materials the
thermally unstable at thermal spray temperatures, attempts were made to form an FeS
(pyrite) coating by thermally spraying FeS₂ as described by Muffoletto. First attempt:

employed high-velocity oxygen flame (HVOF). These attempts were unsuccessful in that FeS_2 was not deposited. The deposited material was analyzed by X-ray diffraction (XRD) and was found to be primarily Fe_2O_3 . Further attempts to obtain an FeS_2 coating employed dc-arc plasma spray under an argon cover (250 SCFH) with arc currents of between 200 and 300 A. XRD of the deposited material indicated Fe_7S_8 and not FeS_2 . Representative data is shown in Fig. 1 attached hereto.

4. FeS_2 was plasma sprayed with elemental sulfur. The primary phase of the resulting deposit (>95%) was FeS_2 as shown by the X-ray data in Figure 1.

5. Discharge traces were recorded for cells employing natural FeS_2 , FeS_2 plasma sprayed without sulfur and FeS_2 plasma sprayed with sulfur. These discharge traces are shown in Fig. 2 attached hereto. The discharge traces corroborate the above described XRD data in that the FeS_2 plasma sprayed without sulfur exhibits a significantly different trace than the natural pyrite and the FeS_2 plasma sprayed with sulfur. Additionally the discharge traces of the cell employing FeS_2 plasma sprayed with sulfur paralleled the discharge traces of the cell employing natural pyrite.

6. Thus, based on my knowledge of the thermal spray field and the above described experiments and data, I believe the presence of a protective coating such as elemental sulfur is to be necessary to produce a thermally sprayed electrode comprising FeS_2 or other material that is unstable at thermal spray temperatures.

7. I declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and those like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

Date: 6/26/02

Tung Xiao
Tongshan D. Xiao